US009307242B2

(12) **United States Patent**
Asaka et al.

(10) **Patent No.:** **US 9,307,242 B2**
(45) **Date of Patent:** ***Apr. 5, 2016**

(54) **VIDEO ENCODING APPARATUS AND VIDEO DECODING APPARATUS**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **14/192,485**

(22) Filed: **Feb. 27, 2014**

(65) **Prior Publication Data**

US 2014/0177727 A1 Jun. 26, 2014

Related U.S. Application Data

(63) Continuation-in-part of application No. 13/325,856, filed on Dec. 14, 2011, which is a continuation of application No. PCT/JP2009/061130, filed on Jun. 18, 2009.

(51) **Int. Cl.**
H04N 7/12 (2006.01)
H04N 19/583 (2014.01)
(Continued)

(52) **U.S. Cl.**
CPC ***H04N 19/00733*** (2013.01); ***H04N 19/46*** (2014.11); ***H04N 19/463*** (2014.11);
(Continued)

(58) **Field of Classification Search**
CPC H04N 7/015–7/0157; H04N 11/02; H04N 19/122
USPC 375/240
See application file for complete search history.

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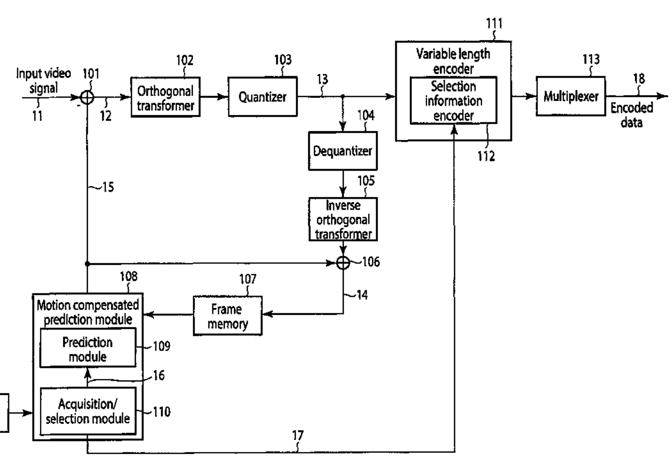
(57) **ABSTRACT**

A video encoding apparatus is a video encoding apparatus for subjecting a video image to motion compensated prediction coding, comprising an acquisition module to acquire available blocks of blocks having motion vectors from encoded blocks adjacent to a to-be-encoded block and number of the available blocks, an acquisition/selection module to select one selection block from the encoded available blocks, a selection information encoder to encode selection information specifying the selection block using a code table corresponding to the number of available blocks, and an image encoder to subject the to-be-encoded block to motion compensated prediction coding using a motion vector of the selection block.

3 Claims, 13 Drawing Sheets



(51) **Int. Cl.**

H04N 19/46	(2014.01)
H04N 19/51	(2014.01)
H04N 19/513	(2014.01)
H04N 19/463	(2014.01)
H04N 19/91	(2014.01)
H04N 19/13	(2014.01)
H04N 19/593	(2014.01)

(52) **U.S. Cl.**

CPC ***H04N 19/51*** (2014.11); ***H04N 19/513*** (2014.11); ***H04N 19/91*** (2014.11); *H04N 19/13* (2014.11); *H04N 19/593* (2014.11)

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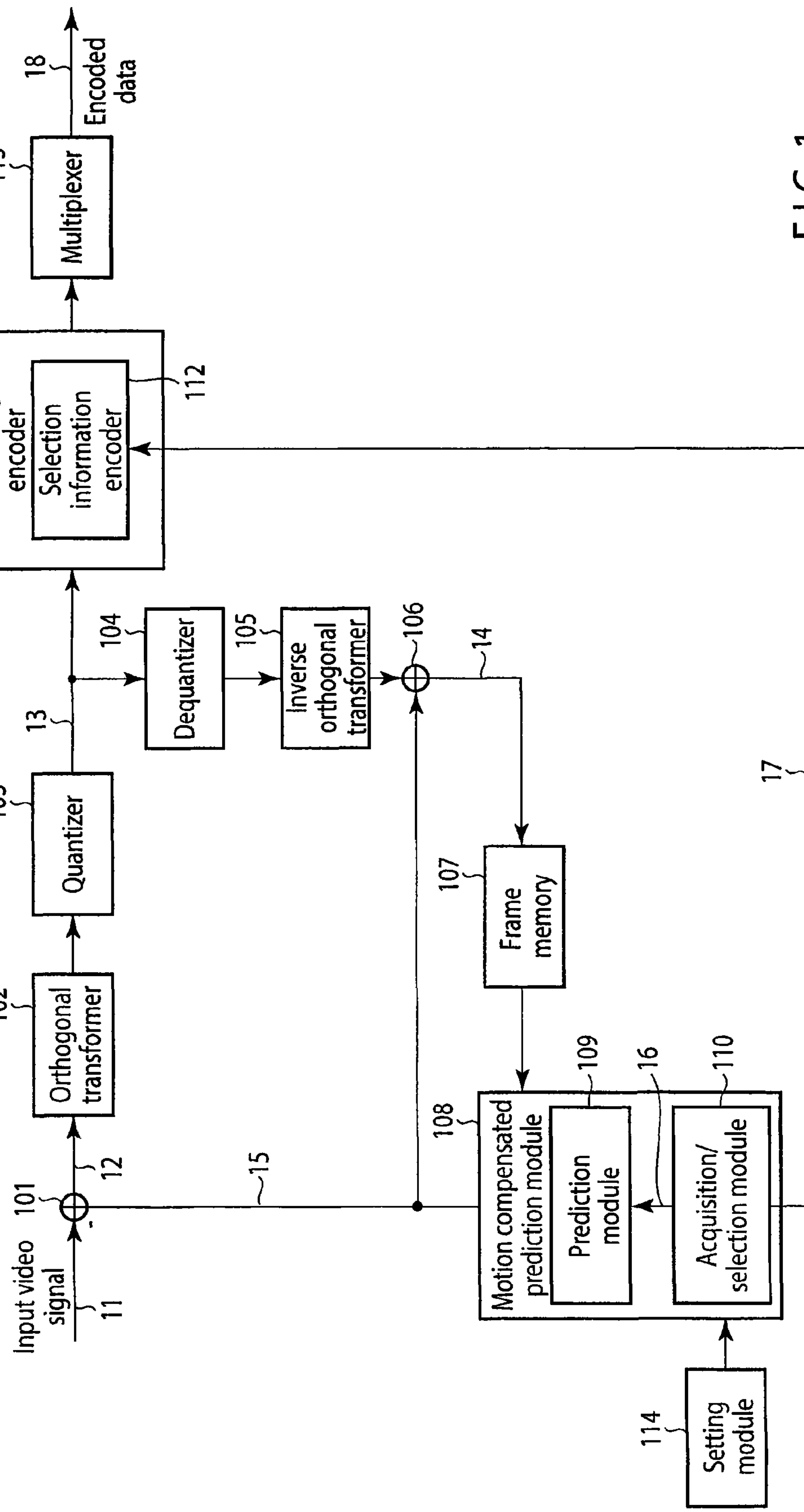
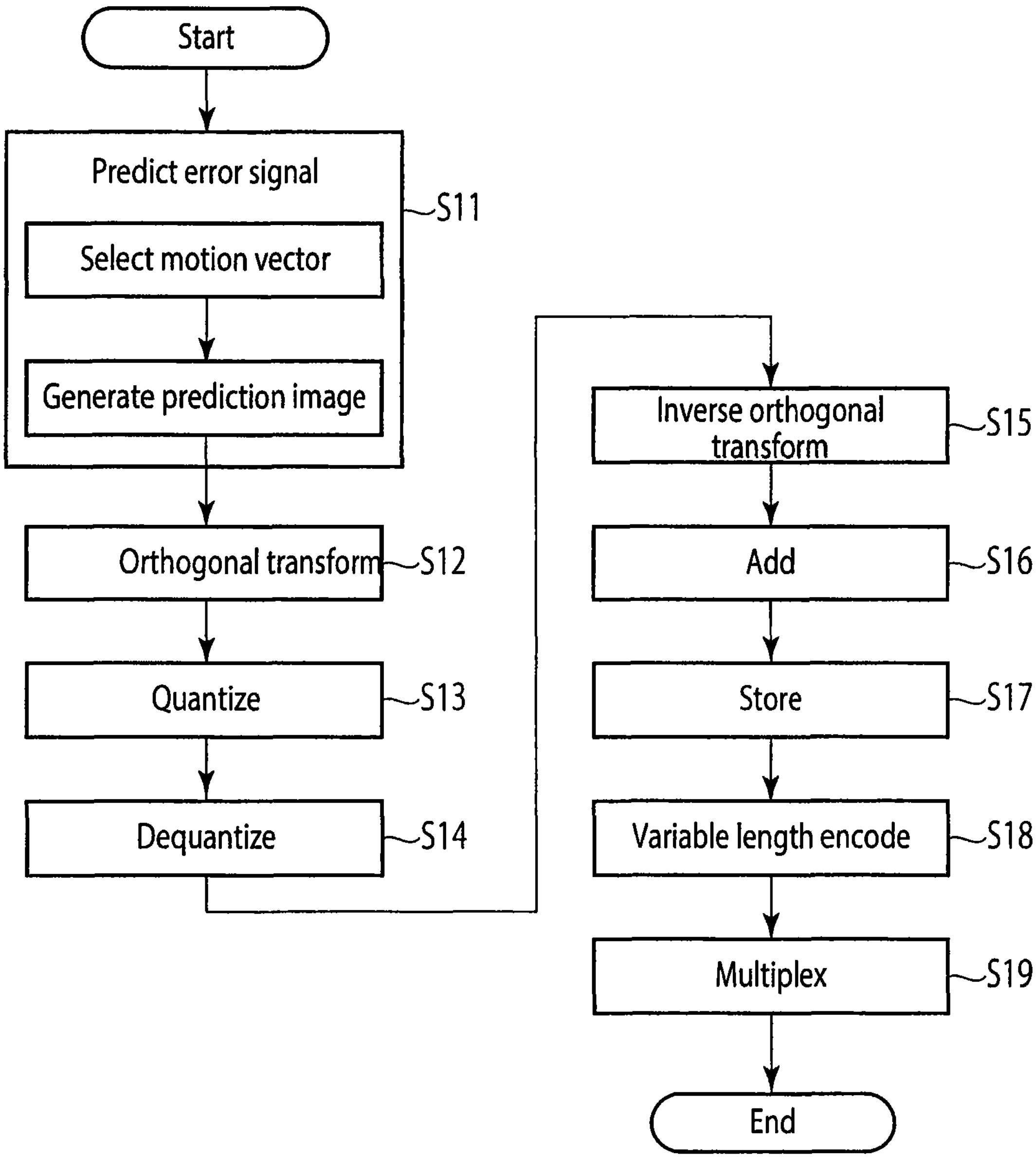


Input video signal
11
101
12
Orthogonal transformer
102
Quantizer
103
13
Dequantizer
104
Inverse orthogonal transformer
105
106
14
Frame memory
107
Motion compensated prediction module
108
Prediction module
109
16
Acquisition/selection module
110
15
17
Setting module
114
Variable length encoder
111
Selection information encoder
112
Multiplexer
113
18
Encoded data

F I G. 1


Start
Predict error signal
Select motion vector
Generate prediction image
S11
Orthogonal transform
S12
Quantize
S13
Dequantize
S14
Inverse orthogonal transform
S15
Add
S16
Store
S17
Variable length encode
S18
Multiplex
S19
End

F I G. 2

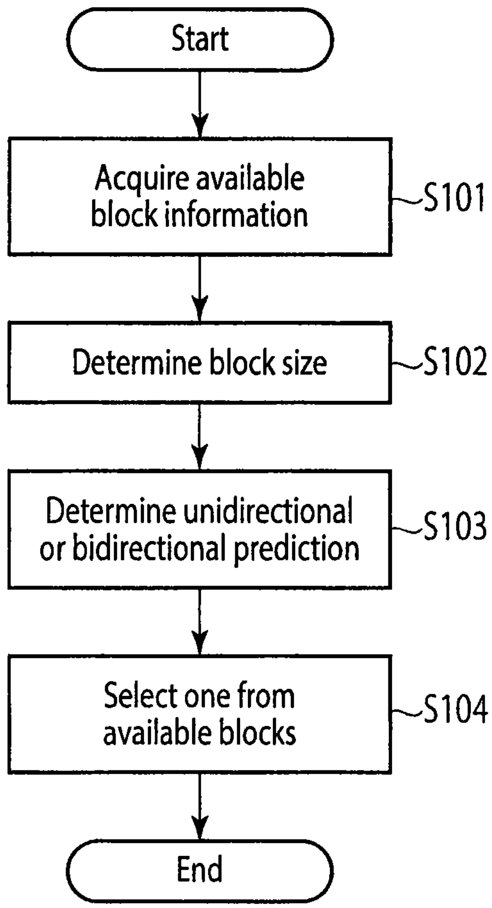

Start
Acquire available block information
S101
Determine block size
S102
Determine unidirectional or bidirectional prediction
S103
Select one from available blocks
S104
End

FIG. 3

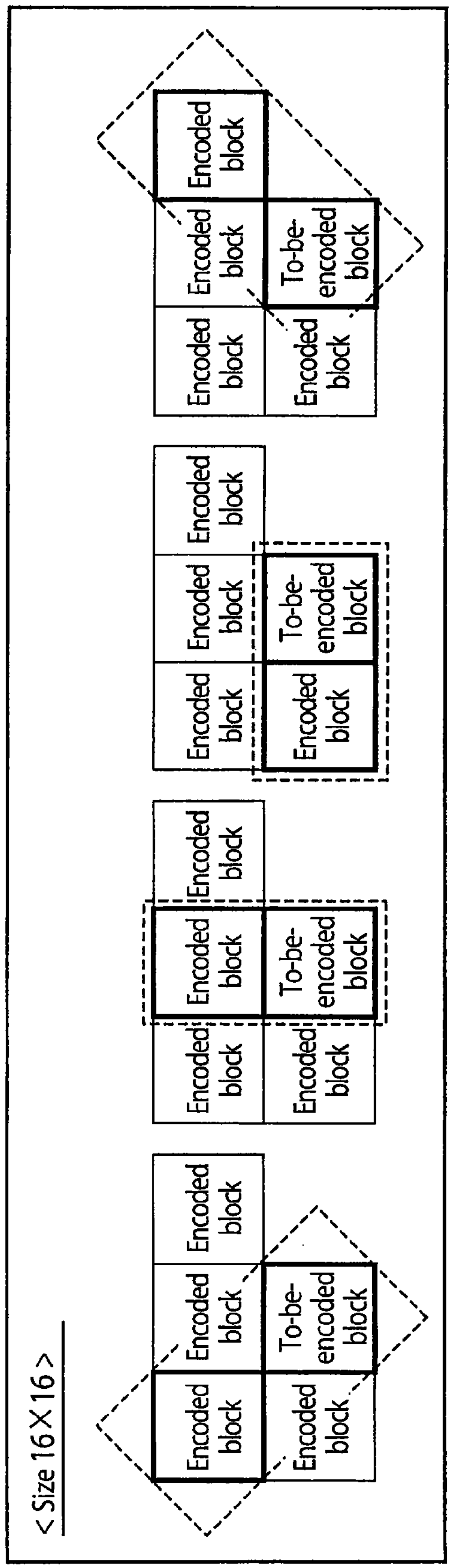

< Size 16X16 >
Encoded block
Encoded block
Encoded block
Encoded block
To-be-encoded block
Encoded block
Encoded block
Encoded block
Encoded block
Encoded block
To-be-encoded block
Encoded block
Encoded block
Encoded block
Encoded block
To-be-encoded block
Encoded block
Encoded block
Encoded block
Encoded block
To-be-encoded block

FIG. 4A

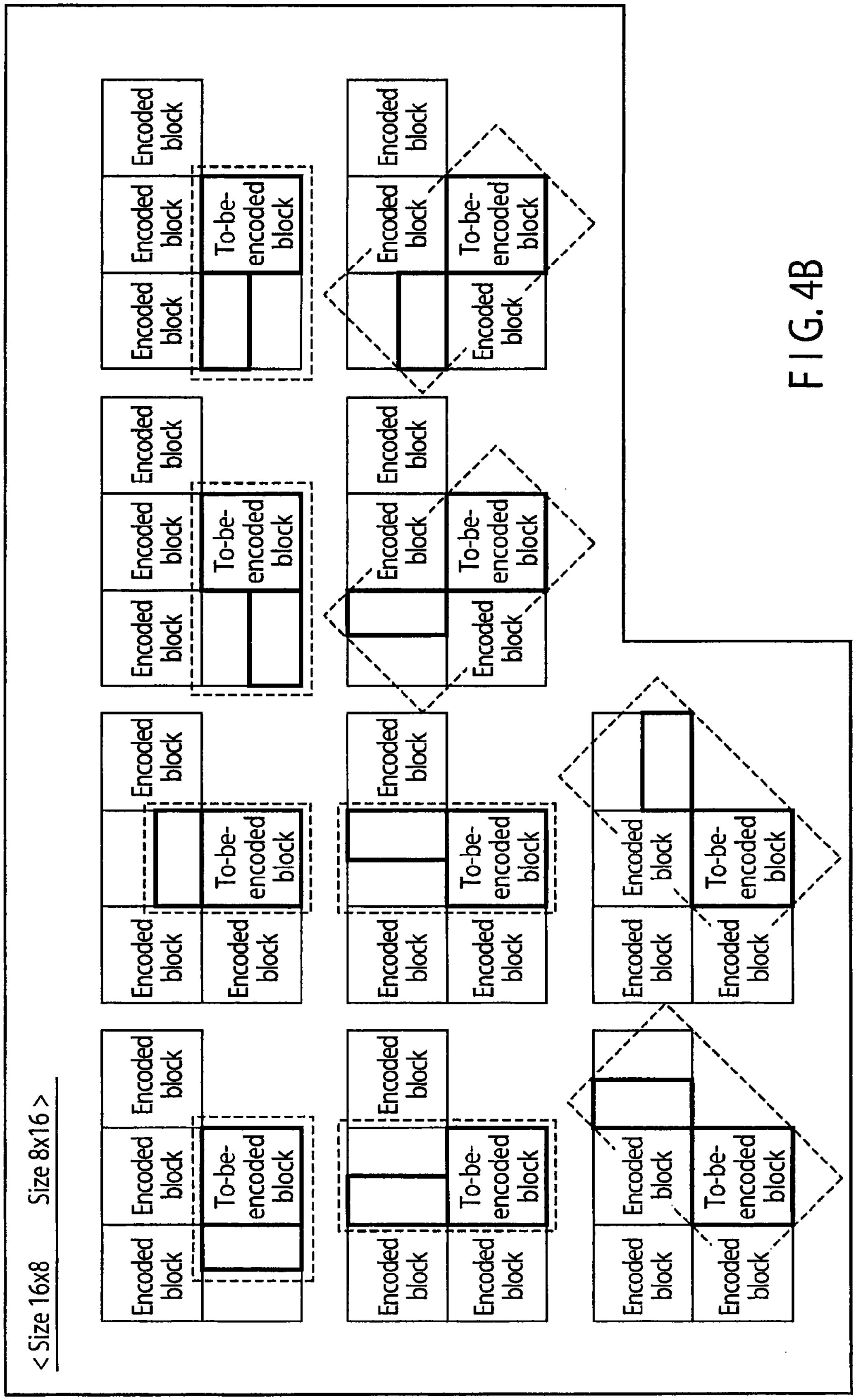


FIG. 4B

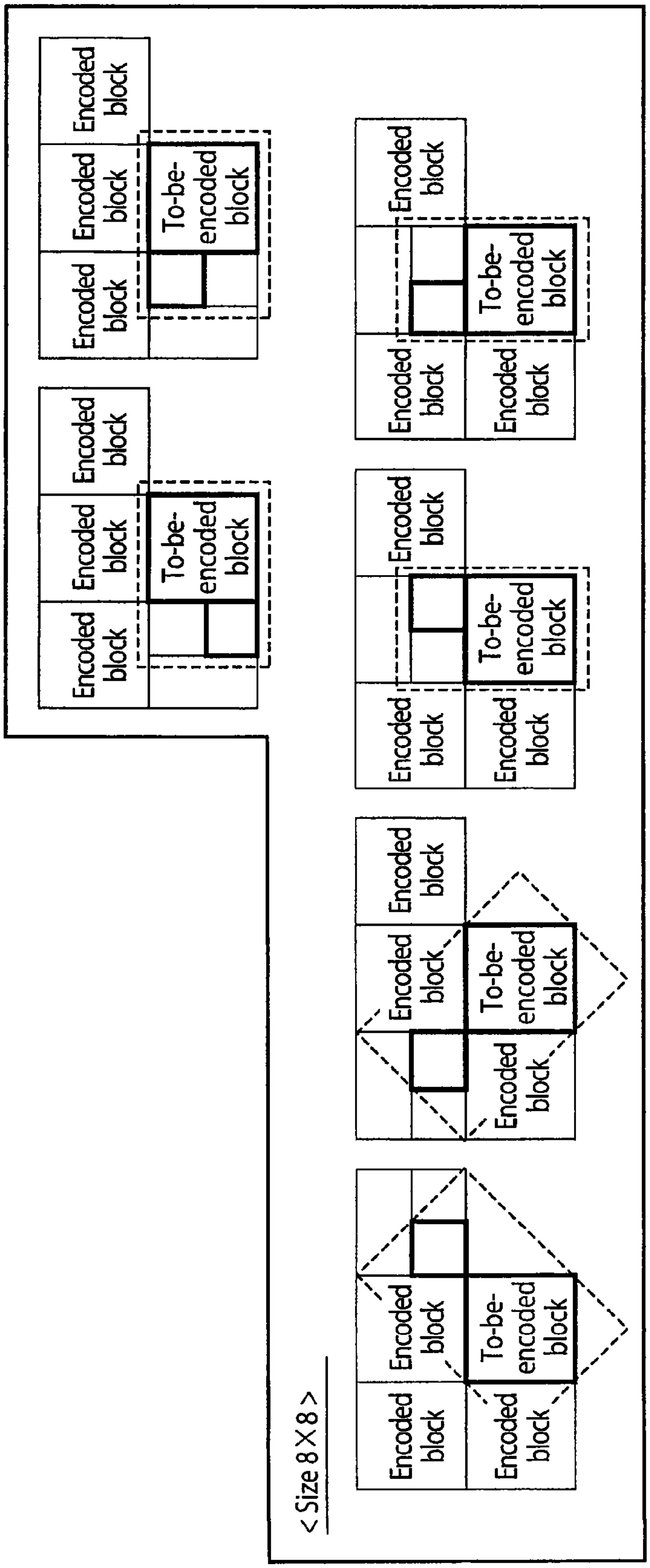


FIG. 4C

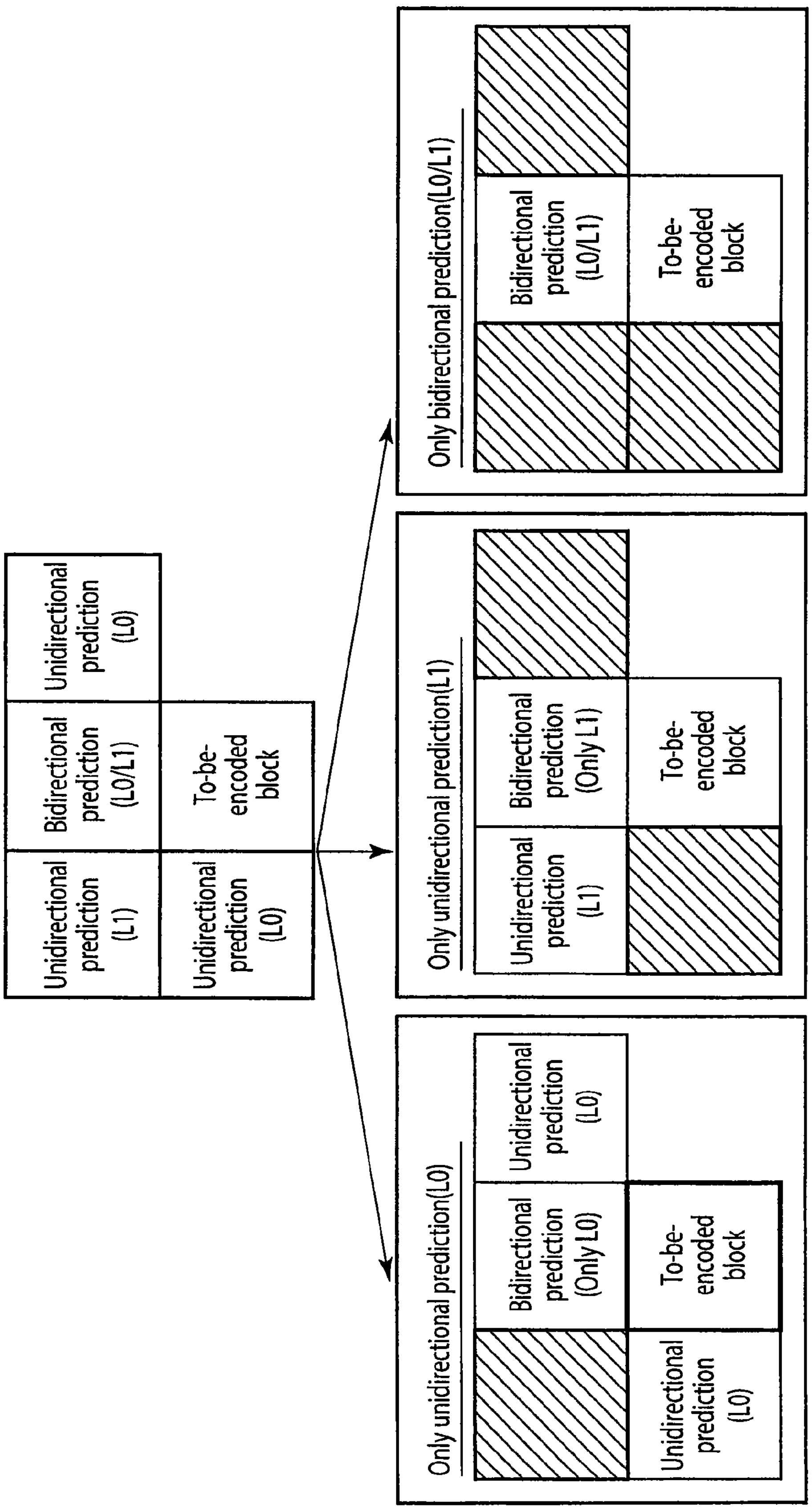

Unidirectional prediction (L1)
Bidirectional prediction (L0/L1)
Unidirectional prediction (L0)
Unidirectional prediction (L0)
To-be-encoded block
Only unidirectional prediction(L0)
Unidirectional prediction (L0)
Bidirectional prediction (Only L0)
Unidirectional prediction (L0)
To-be-encoded block
(a)
Only unidirectional prediction(L1)
Unidirectional prediction (L1)
Bidirectional prediction (Only L1)
To-be-encoded block
(b)
Only bidirectional prediction(L0/L1)
Bidirectional prediction (L0/L1)
To-be-encoded block
(c)

FIG. 5

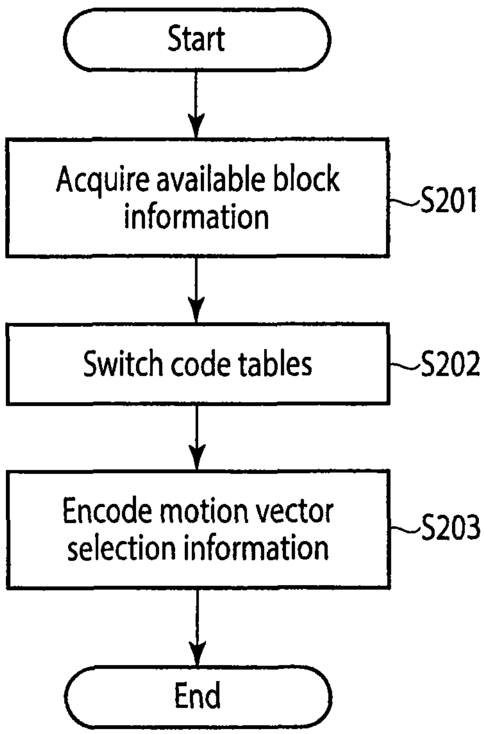

Start
Acquire available block information
S201
Switch code tables
S202
Encode motion vector selection information
S203
End

FIG. 6

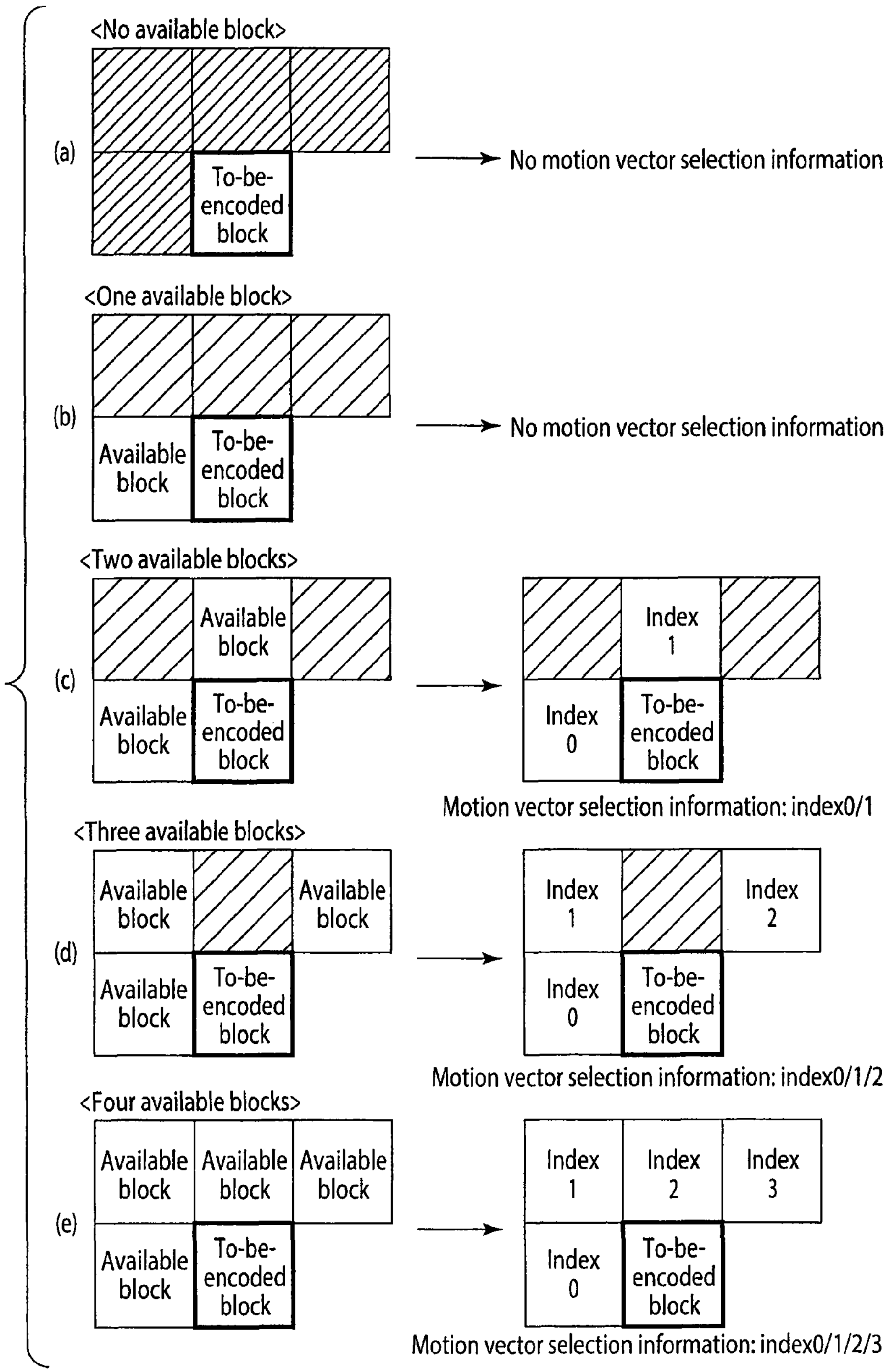

<No available block>
(a)
To-be-encoded block
No motion vector selection information
<One available block>
(b)
Available block
To-be-encoded block
No motion vector selection information
<Two available blocks>
(c)
Available block
Available block
To-be-encoded block
Index 1
Index 0
To-be-encoded block
Motion vector selection information: index0/1
<Three available blocks>
(d)
Available block
Available block
Available block
To-be-encoded block
Index 1
Index 2
Index 0
To-be-encoded block
Motion vector selection information: index0/1/2
<Four available blocks>
(e)
Available block
Available block
Available block
Available block
To-be-encoded block
Index 1
Index 2
Index 3
Index 0
To-be-encoded block
Motion vector selection information: index0/1/2/3

FIG. 7

<Two available blocks>

Index	Code word
0	0
1	1

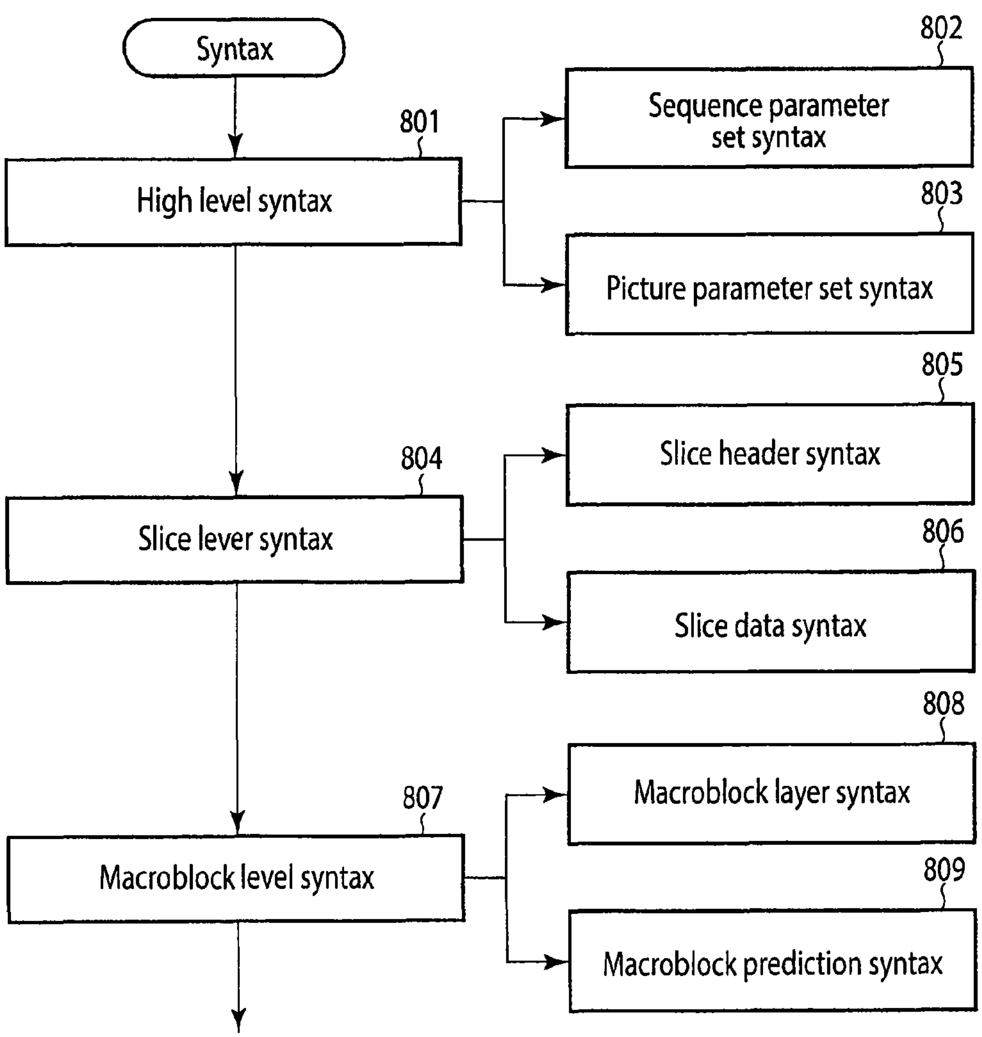
<Three available blocks>

Index	Code word
0	0
1	10
2	11

<Four available blocks>

Index	Code word
0	0
1	10
2	110
3	111

F I G. 8



F I G. 9

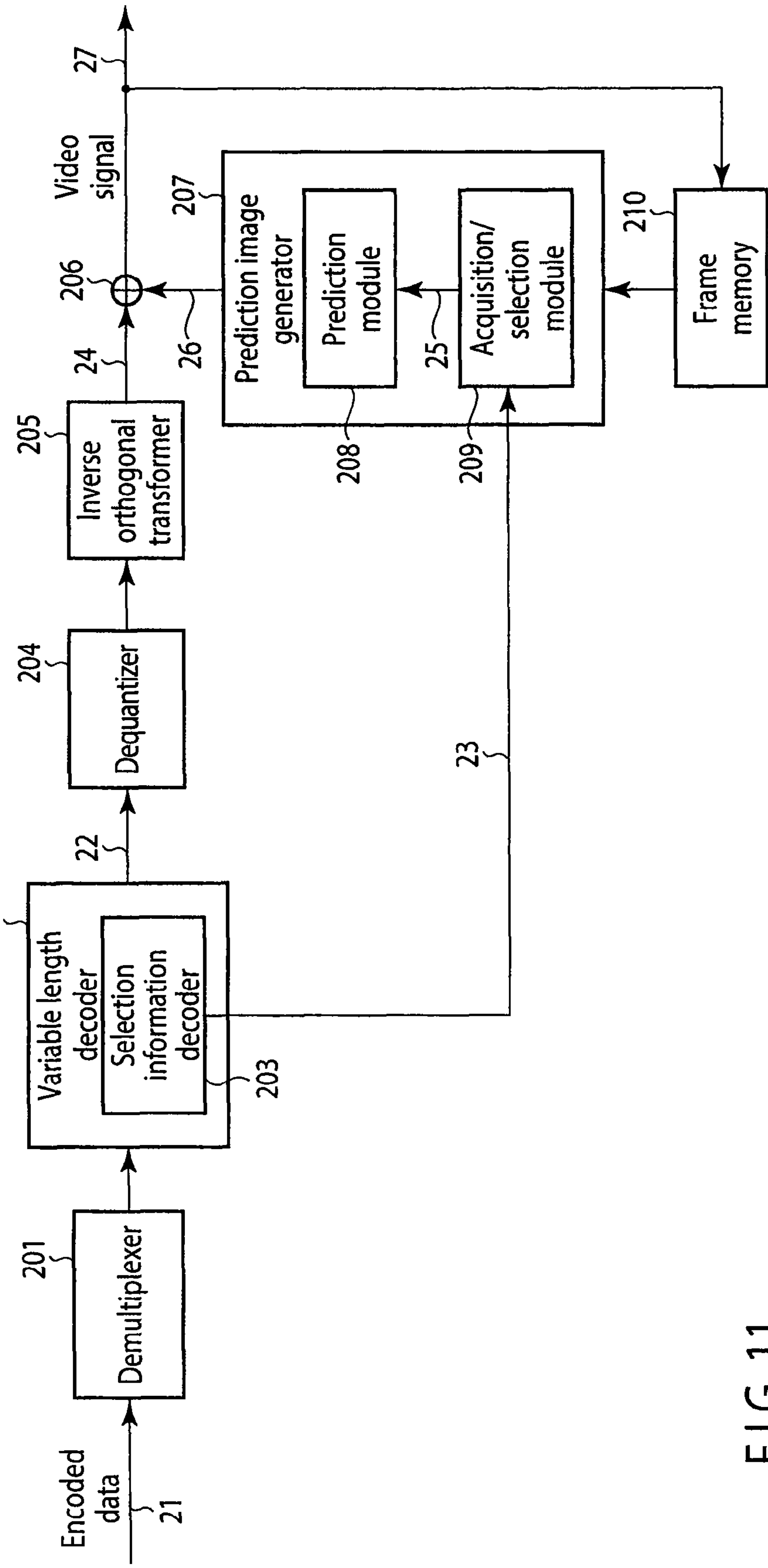
```
Macroblock_layer( ){
  mb_type
  if (available_block_num>0)
    mv_copy_flag
  if (mvcopy_flag && available_block_num>1)
    mv_select_info
  ...
}
```

(a)

```
Macroblock_layer( ){
  if (available_block_num>0)
    mv_copy_flag
  if (mvcopy_flag && available_block_num>1)
    mv_select_info
  if (mvcopy_flag == 0)
    mb_type
  ...
}
```

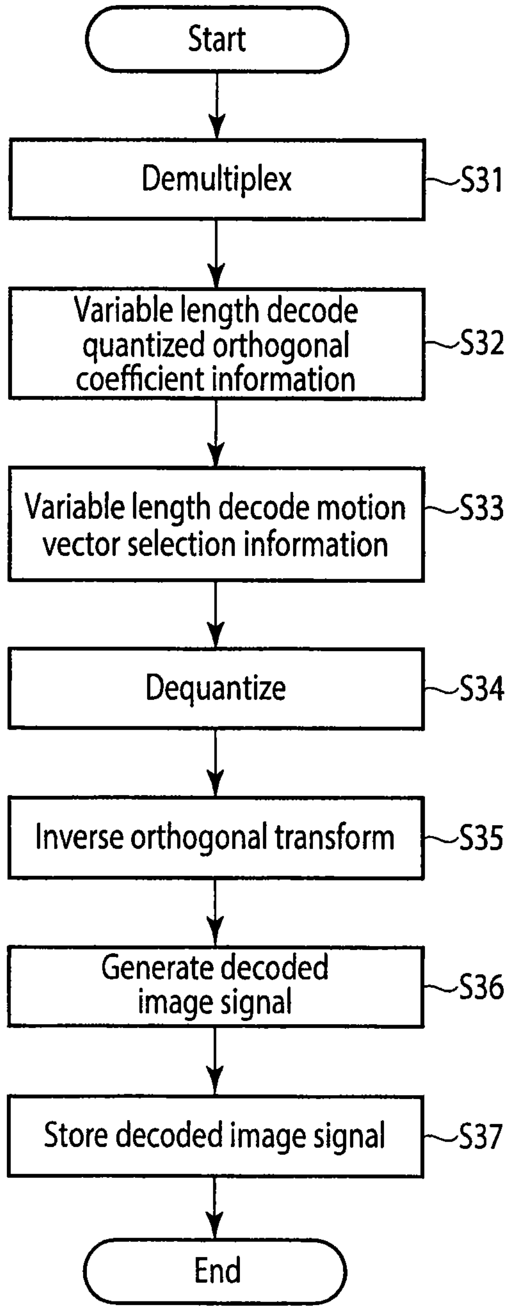
(b)

FIG. 10



Encoded data
21
Demultiplexer
201
Variable length decoder
202
Selection information decoder
203
22
Dequantizer
204
Inverse orthogonal transformer
205
24
206
Video signal
27
23
Prediction image generator
207
Prediction module
208
Acquisition/selection module
209
25
26
Frame memory
210

F I G. 11


Start
Demultiplex
S31
Variable length decode quantized orthogonal coefficient information
S32
Variable length decode motion vector selection information
S33
Dequantize
S34
Inverse orthogonal transform
S35
Generate decoded image signal
S36
Store decoded image signal
S37
End

F I G. 12

VIDEO ENCODING APPARATUS AND VIDEO DECODING APPARATUS

CROSS-REFERENCE TO RELATED APPLICATIONS

This is a Continuation-In-Part Application of Continuation application Ser. No. 13/325,856, filed Dec. 14, 2011, which is a Continuation Application of PCT Application No. PCT/JP2009/061130, filed Jun. 18, 2009, which was published under PCT Article 21(2) in Japanese, and the entire contents of which are incorporated herein by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a video encoding apparatus and a video decoding apparatus which derive a motion vector from an encoded and decoded image and perform a motion compensated prediction.

2. Description of the Related Art

There is a motion compensated prediction as one of techniques used for encoding a video image.

In the motion compensated prediction, a video encoding apparatus acquires a motion vector using a to-be-encoded image to be newly encoded and a local decoded image already generated and generates a prediction image by carrying out motion compensation using this motion vector.

As one of methods for acquiring a motion vector in the motion compensated prediction, there is a direct mode for generating a prediction image using a motion vector of a to-be-encoded block derived from the motion vector of an encoded block (refer to Japanese Patent No. 4020789 and U.S. Pat. No. 7,233,621). Because the motion vector is not encoded in the direct mode, the number of encoded bits of the motion vector information can be reduced. The direct mode is employed in H.264/AVC.

BRIEF SUMMARY OF THE INVENTION

In the direct mode, a motion vector is generated by a method for calculating a motion vector from a median value of the motion vector of an encoded block adjacent to a to-be-encoded block in generating the motion vector of the to-be-encoded block by prediction. Therefore, degrees of freedom for calculating the motion vector calculation are low. In addition, when a method for calculating a motion vector by selecting one from a plurality of encoded blocks is used for improving the degrees of freedom, the position of the block must be always sent as motion vector selection information in order to indicate the selected encoded block. For this reason, the number of encoded bits may be increased.

It is an object of the present invention to provide a video encoding apparatus and a video decoding apparatus which reduce additional information of motion vector selection information while improving the degrees of freedom for calculating the motion vector by selecting one from encoded blocks.

An aspect of the present invention provides a video encoding apparatus for subjecting a video image to motion compensated prediction encoding, the apparatus comprising an acquisition module for acquiring available blocks having motion vectors and the number of the available blocks from encoded blocks adjacent to a to-be-encoded block, a selection module for selecting a selection block from the available blocks of the encoded blocks, a selection information encoding module for encoding selection information specifying the selection block using a code table corresponding to the number of the available blocks, and an image encoding module for subjecting the to-be-encoded block to motion compensated prediction encoding using the motion vector of the selected block.

Another aspect of the present invention provides a video decoding apparatus for subjecting a video image to motion compensated prediction decoding, the apparatus comprising a selection information decoding module for decoding selection information by switching a code table according to the number of available blocks of decoded blocks having motion vectors and neighboring a to-be-decoded block, a selection module for selecting a selection block from available blocks according to the selection information, and an image decoding module for subjecting a to-be-decoded image to motion compensated prediction decoding using a motion vector of the selection block by the selection module.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

FIG. **1** is a block diagram of a video encoding apparatus related to an embodiment of the present invention.

FIG. **2** is a flowchart representing a processing procedure of the video encoding apparatus.

FIG. **3** is a flowchart representing a processing procedure of an acquisition/selection module.

FIG. **4**A is a diagram for describing a discrimination method based on a block size.

FIG. **4**B is a diagram for describing a discrimination method based on a block size.

FIG. **4**C is a diagram for describing a discrimination method based on a block size.

FIG. **5** is a diagram for describing a discrimination method by a unidirectional or a bidirectional.

FIG. **6** is a flowchart representing a processing procedure of a selection information encoder.

FIG. **7** shows an example of an index of selection information.

FIG. **8** shows an example of a code table of selection information.

FIG. **9** is a schematic view of a syntax structure.

FIG. **10** shows a data structure of a macroblock layer.

FIG. **11** shows a block diagram of a video decoding apparatus related to the embodiment of the present invention.

FIG. **12** shows a flowchart representing a processing procedure of the video decoding apparatus.

DETAILED DESCRIPTION OF THE INVENTION

There will now be explained embodiments of the present invention referring to drawings.

A video encoding apparatus related to an embodiment is described with reference to FIG. **1** hereinafter. A subtracter **101** calculates a difference between an input video signal **11** and a predictive coded video signal **15**, and output a prediction error signal **12**. The output terminal of the subtracter **101** is connected to a variable length encoder **111** through an orthogonal transformer **102** and a quantizer **103**. The orthogonal transformer **102** orthogonal-transforms a prediction error signal **12** from the subtracter **101**, and the quantizer **103** quantizes an orthogonal transformation coefficient and outputs quantization orthogonal transformation coefficient information **13**. The variable length encoder **111** performs variable length encoding on the quantization orthogonal transformation coefficient information **13** from the quantizer **103**.

The output terminal of the quantizer **103** is connected to an adder **106** through a dequantizer **104** and an inverse orthogonal transformer **105**. The dequantizer **104** dequantizes the quantized orthogonal transformation coefficient information **13**, and converts it in an orthogonal transformation coefficient. The inverse orthogonal transformer **105** converts the orthogonal transformation coefficient to a prediction error signal. The adder **106** adds the prediction error signal of the inverse orthogonal transformer **105** and the predictive coded video signal **15** to generate a local decoded image signal **14**. The output terminal of the adder **106** is connected to a motion compensated prediction module **108** through a frame memory **107**.

The frame memory **107** accumulates a local decoded image signal **14**. A setting module **114** sets a motion compensated prediction mode (a prediction mode) of a to-be-encoded block. The prediction mode includes a unidirectional prediction using a single reference picture and a bidirectional prediction using two reference pictures. The unidirectional prediction includes L**0** prediction and L**1** prediction of AVC. A motion compensated prediction module **108** comprises a prediction module **109** and an acquisition/selection module **110**.

The acquisition/selection module **110** acquires available blocks having motion vectors and the number of the available blocks from encoded blocks adjacent to the to-be-encoded block, and selects a selection block from the available blocks. The motion compensated prediction module **108** performs a prediction using a local decoded image signal **14** stored in the frame memory **107** as a reference image and generates a predictive coded video signal **15**. The acquisition/selection module **110** selects one block (a selection block) from the adjacent blocks adjacent to the to-be-encoded block. For example, the block having an appropriate motion vector among the adjacent blocks is selected as the selection block. The acquisition/selection module **110** selects the motion vector of the selection block as a motion vector **16** to be used for the motion compensated prediction, and sends it to the prediction module **109**. In addition, the acquisition/selection module **110** generates selection information **17** of the selection block and sends it to the variable length encoder **111**.

The variable length encoder **111** has a selection information encoder **112**. The selection information encoder **112** subjects the selection information **17** to variable length encoding while switching a code table so as to have therein the same number of entries as the available blocks of encoded blocks. The available block is a block having a motion vector among encoded blocks adjacent to the to-be-encoded block. A multiplexer **113** multiplexes quantized orthogonal transformation coefficient information and selection information and output encoded data.

The action of the video encoding apparatus of the above configuration will be described referring to the flowchart of FIG. **2**.

At first a prediction error signal **12** is generated (S**11**). In generation of this prediction error signal **12**, a motion vector is selected, and a prediction image is generated using the selected motion vector. The subtracter **101** calculates a difference between the signal of the prediction image, that is, the prediction image signal **15** and the input video signal **11** to generate the prediction error signal **12**.

The orthogonal transformer **102** orthogonal-transforms the prediction error signal **12** to generate an orthogonal transformed coefficient (S**12**). The quantizer **103** quantizes the orthogonal transformed coefficient (S**13**). The dequantizer **104** dequantizes the quantized orthogonal transformed coefficient information (S**14**), and then subjects it to inverse orthogonal transform to provide a reproduced prediction error signal (S**15**). The adder **106** adds the reproduced prediction error signal and the predictive coded video signal **15** to generate a local decoded image signal **14** (S**16**). The local decoded image signal **14** is stored in the frame memory **107** (as a reference picture) (S**17**), and the local decoded image signal read from the frame memory **107** is inputted to the motion compensated prediction module **108**.

The prediction module **109** of the motion compensated prediction module **108** subjects the local decoded image signal (reference image) to motion compensated prediction using the motion vector **16** to generate the predictive coded video signal **15**. The predictive coded video signal **15** is sent to the subtracter **101** to calculate a difference with respect to the input video signal **11**, and further is sent to the adder **106** to generate the local decoded image signal **14**.

The acquisition/selection module **110** selects a selection block from adjacent blocks, generates selection information **17**, and sends a motion vector **16** of the selection block to the prediction module **109** which performs the motion compensated prediction using the motion vector of the selection block. The selection information **17** is sent to the selection information encoder **112**. When the selection block is selected from the adjacent blocks, the adjacent block having the appropriate motion vector allowing the amount of encoded bits to be decreased is selected.

The orthogonal transformation coefficient information **13** quantized with the quantizer **103** also is input to the variable length encoder **111** and is subjected to variable length coding (S**18**). The acquisition/selection module **110** outputs the selection information **16** used for motion compensated prediction, and inputs it to the selection information encoder **112**. The selection information encoder **112** switches the code table so as to have therein the same number of entries as the available blocks of the encoded blocks neighboring the to-be-encoded block and having motion vectors, and the selection information **17** is subjected to variable length coding. The multiplexer **113** multiplexes the quantized orthogonal transformation coefficient information from the variable length encoder **111** and the selection information to output a bit stream of coded data **18** (S**19**). The coded data **18** is sent to a storage system (not shown) or a transmission path.

In the flowchart of FIG. **2**, the flow of steps S**14** to S**17** may be replaced by the flow of steps S**18** and S**19**.

In other words, the variable length coding step S**18** and multiplexing step S**19** may be executed following the quantization step S**13**, and the dequantizing step S**14** to the storage step S**17** may be executed following the multiplexing step S**19**.

The action of the acquisition/selection module **110** will be described referring to flowchart shown in FIG. **3**.

At first the available block candidates being the encoded blocks neighboring the to-be-encoded block and having motion vectors are searched for (S**101**). When the available block candidates are searched for, the block size for motion compensated prediction of these available block candidates is determined (S**102**). Next, it is determined whether the available block candidates are a unidirectional prediction or a bidirectional prediction (S**103**). An available block is extracted from the available block candidates based on the determined result and the prediction mode of the to-be-encoded block. One selection block is selected for from the extracted available blocks, and information specifying the selection block is acquired as selection information (S**104**).

There will be described a process for determining a block size referring to FIGS. **4**A to **4**C (S**102**).

The adjacent blocks used in the present embodiment are assumed to be blocks, which are positioned at the left, upper left, upper and upper right of the to-be-encoded block. Therefore, when the to-be-encoded block positions the most upper left of the frame, this to-be-encoded block cannot be applied to the present invention because there is not the available block adjacent to the to-be-encoded block. When the to-be-encoded block is on the upper end of the screen, the available block is only a left block, and when the to-be-encoded block is on the extreme left and not on the extreme upper end, the two blocks of the to-be-encoded blocks which position the upper and upper right thereof.

When the block size is a size 16×16, the block sizes for motion compensated prediction of the adjacent blocks are four kinds of size 16×16, size 16×8, size 8×16 and size 8×8 as shown in FIGS. **4**A to **4**C. Considering these four kinds, the adjacent blocks that may be available blocks are 20 kinds as shown in FIGS. **4**A to **4**C. In other words, there are four kinds for size 16×16 as shown in FIG. **4**A, 10 kinds for size 16×8 as shown in FIG. **4**B, and six kinds for size 8×8 as shown in FIG. **4**C. In discrimination of the block size (S**102**), the available block is searched for according to the block size from 20 kinds of blocks. For example, when the size of the available block is assumed to be only size 16×16, the available blocks determined by this block size are four kinds of blocks of size 16×16 as shown in FIG. **4**A. In other words, the available blocks are a block on the upper left side of the to-be-encoded block, a block on the upper side of the to-be-encoded block, and a block on the left side of the to-be-encoded block and a block on the upper right side of the to-be-encoded block. In addition, even if the macroblock size was expanded not less than size 16×16, it can be the available block similarly to the macroblock size of 16×16. For example, when the macroblock size is 32×32, the block size for motion compensated prediction of the adjacent block are four kinds of size 32×32, size 32×16, size 16×32, and size 16×16, and the adjacent blocks that may be the available blocks are 20 kinds.

There will be described the determination of the unidirectional prediction or bidirectional prediction which is executed by the acquisition/selection module **110** (S**103**) with reference to FIG. **5**.

For example, the block size is limited to 16×16, and the unidirectional or bidirectional prediction of the adjacent block with respect to the to-be-encoded block is assumed to be a case as shown in FIG. **5**. In discrimination of the unidirectional or bidirectional prediction (S**103**), the available block is searched for according to the direction of prediction. For example, the adjacent block having a prediction direction L**0** is assumed to be an available block determined in the prediction direction. In other words, the upper, left and upper right blocks of the to-be-encoded blocks shown in FIG. **5**(*a*) are available blocks determined in the prediction direction. In this case, the upper left block of the to-be-encoded blocks is not employed. When the adjacent block including the prediction direction L**1** is assumed to be the available block determined in the prediction direction, the upper left and upper blocks of the to-be-encoded blocks shown in FIG. **5**(*b*) are available blocks determined in the prediction direction. In this case, the left and upper right blocks of the to-be-encoded blocks are not employed. When the adjacent block including the prediction direction L**0**/L**1** is assumed to be the available block determined in the prediction direction, only the upper block of the to-be-encoded blocks shown in FIG. **5**(*c*) is the available block determined in the prediction direction. In this case, the left, upper left and upper right blocks of the to-be-encoded blocks are not employed. In addition, the prediction direction L**0** (L**1**) corresponds to the prediction direction of the L**0** prediction (L**1** prediction) in AVC.

There will be described the selection information encoder **112** referring to flowchart shown in FIG. **6**.

The available block of the encoded block having a motion vector is searched for from among adjacent blocks adjacent to the to-be-encoded block, and the available block information determined by the block size and the unidirectional or bidirectional prediction is acquired (S**201**). The code tables corresponding to the number of available blocks as shown in FIG. **8** are switched using this available block information (S**202**). The selection information **17** sent from the acquisition/selection module **110** is subjected to variable length coding using a changed code table (S**203**).

An example of an index of selection information is explained referring to FIG. **7** next.

When there is no available block as shown in FIG. **7**(*a*), the selection information is not sent because the present invention is inapplicable to this block. When there is one available block as shown in FIG. **7**(*b*), the selection information is not sent because a motion vector of an available block used for motion compensation of the to-be-encoded block is determined in unique. When there are two available blocks as shown in FIG. **7**(*c*), the selection information of an index **0** or **1** is sent. When there are three available blocks as shown in FIG. **7**(*d*), the selection information of an index **0**, **1** or **2** is sent. When there are four available blocks as shown in FIG. **7**(*e*), the selection information of an index **0**, **1**, **2** or **3** is sent.

In addition, as an example of setting an index of the available block, an example of setting the index to the available block in order of the left, upper left, upper and upper right of the to-be-encoded blocks is shown in FIG. **7**. In other words, the index is set to the block to be used except for the block which is not used.

There will be described a code table of the selection information **17** referring to FIG. **8** next.

The selection information encoder **112** switches the code table according to the number of available blocks (S**202**). As mentioned above, when there are two or more available blocks, the selection information **17** must be encoded.

At first when there are two available blocks, indexes **0** and **1** are needed, and the code table is indicated by the table on the left side of FIG. **8**. When there are three available blocks, indexes **0**, **1** and **2** are needed, and the code table is indicated by the table on the center of FIG. **8**. When there are four available blocks, indexes **0**, **1**, **2**, **3** and **4** are needed, and the code table is indicated by the table on the right side of FIG. **8**. These code tables are switched according to the number of available blocks.

There will be explained an encoding method of the selection information.

FIG. **9** shows a schematic diagram of a structure of syntax used in this embodiment.

The syntax comprises mainly three parts, wherein High Level Syntax **801** is filled with syntax information of the upper layer not less than a slice. Slice Level Syntax **804** specifies information necessary for every slice, Macroblock Level Syntax **807** specifies a variable length coded error signal or mode information which is needed for every macroblock.

These syntaxes each comprise more detailed syntaxes. The High Level Syntax **801** comprises syntaxes of sequence and picture levels such as Sequence parameter set syntax **802** and Picture parameter set syntax **803**. Slice Level Syntax **804** comprises Slice header syntax **405**, Slice data syntax **406** and so on. Further, Macroblock Level Syntax **807** comprises macroblock layer syntax **808**, macroblock prediction syntax **809** and so on.

The syntax information necessary for this embodiment is macroblock layer syntax **808**. The syntax is described hereinafter.

The "available_block_num" shown in FIGS. **10**(*a*) and (*b*) indicates the number of available blocks. When this is two or more, it is necessary to encode the selection information. In addition, the "mvcopy_flag" indicates a flag representing whether the motion vector of the available block is used in the motion compensated prediction. When there are one or more available blocks and the flag is "1", the motion vector of the available block can be used in the motion compensated prediction. Further, the "mv_select_info" indicates the selection information, and the code table is as described above.

FIG. **10**(*a*) shows a syntax when selection information is encoded after "mb_type." When, for example, the block size is only size 16×16, the "mvcopy_flag and mv_select_info" needs not be encoded if the "mb_type" is other than 16×16. If mb_type is 16×16, mvcopy_flag and mv_select_info are encoded.

FIG. **10**(*b*) shows a syntax when selection information is encoded before mb_type. If, for example, mvcopy_flag is 1, it is not necessary to encode mb_type. If mv_copy_flag is 0, mb_type is encoded.

In this embodiment, what order may be employed in a scan order for encoding. For example, a line scan or a Z scan is applicable to the present invention.

There will be a video decoding apparatus related to another embodiment with reference to FIG. **11**.

The coded data **18** output from the video encoding apparatus of FIG. **1** is input to a demultiplexer **201** of the video decoding apparatus as encoded data **21** to be decoded through a storage system or a transmission system. The demultiplexer **201** demultiplexes the encoded data **21** to separate the encoded data **21** into quantization orthogonal transformation coefficient information and selection information. The output terminal of the demultiplexer **201** is connected to a variable length decoder **202**. The variable length decoder **202** decodes the quantization orthogonal transformation coefficient information and the selection information. The output terminal of the variable length decoder **202** is connected to an adder **206** via a dequantizer **204** and an inverse orthogonal transformer **205**. The dequantizer **204** dequantizes the quantized orthogonal transformation coefficient information to transform it to an orthogonal transformation coefficient. The inverse orthogonal transformer **205** subjects the orthogonal transformation coefficient to inverse orthogonal transform to generate a prediction error signal. The adder **206** adds the prediction error signal to the predictive coded video signal from a prediction image generator **207** to produce a video signal.

The prediction image generator **207** includes a prediction module **208** and an acquisition/selection module **209**. The acquisition/selection module **209** selects a selection block from available blocks using selection information **23** decoded by the selection information decoder **203** of the variable length decoder **202** and sends a motion vector **25** of the selection block to a prediction module **208**. The prediction module **208** motion-compensates a reference image stored in a frame memory **210** by the motion vector **25** to produce a prediction image.

The action of the video decoding apparatus of the above configuration will be described referring to flowchart of FIG. **12**.

The demultiplexer **201** demultiplexes the coded data **21** (S**31**), and the variable length decoder **202** decodes it to produce quantized orthogonal transformation coefficient information **22** (S**32**). In addition, the selection information decoder **203** checks the condition of the adjacent block adjacent to a to-be-decoded block and decode it by switching code tables according to the number of the available blocks of the adjacent encoded blocks having motion vectors as shown in FIG. **8**, similarly to the selection information encoder **112** of the encoding apparatus, thereby to produce the selection information **23** (S**33**).

The quantized orthogonal transformation coefficient information **22** that is information output from the variable length decoder **202** is sent to the dequantizer **204**, and the selection information **23** which is information output from selection information decoder **203** is sent to the acquisition/selection module **209**.

The quantization orthogonal transformation coefficient information **22** is dequantized with the dequantizer **204** (S**34**), and then subjected to inverse orthogonal transform with the inverse orthogonal transformer **205** (S**35**). As a result, the prediction error signal **24** is obtained. The adder **206** adds the prediction image signal to the prediction error signal **24** to reproduce a video signal **26** (S**36**). The reproduced video signal **27** is stored in the frame memory **210** (S**37**).

The prediction image generator **207** generates the prediction image **26** using the motion vector of the available block that is the decoded block neighboring the to-be-decoded block and having a motion vector, the motion vector being a motion vector of a selection block selected on the basis of the decoded selection information **23**. The acquisition/selection module **209** selects the selection block from the adjacent blocks on the basis of the available block information of the adjacent block and the selection information **23** decoded with the selection information decoder **203**, similarly to the acquisition/selection module **110** of the coding apparatus. The prediction module **208** generates the prediction image **26** using this selected motion vector **25**, and sends it to the adder **206** to produce a video signal **27**.

According to the present invention, encoding the selection information according to the number of available blocks allows the selection information to be sent using a suitable code table, resulting in that additional information of the selection information can be reduced.

In addition, using the motion vector of the available block for the motion compensated prediction of the to-be-encoded block allows the additional information on the motion vector information to be reduced.

Furthermore, the motion vector calculation method is not fixed and improves degrees of freedom of motion vector calculation as compared with a direct mode by selecting an appropriate one from among the available blocks.

The technique of the present invention recited in the embodiment of the present invention may be executed with a computer and also may be distributed as a program capable of causing a computer to execute by storing it in a recording medium such as a magnetic disk (flexible disk, a hard disk, etc.), an optical disk (CD-ROM, DVD, etc.), a semiconductor memory, etc.

In addition, the present invention is not limited to the above embodiments and may be modified in component within a scope without departing from the subject matter of the invention.

In addition, it is possible to provide various inventions by combining appropriately a plurality of components disclosed in the above embodiments. For example, some components may be deleted from all components shown in the embodiments. Further, the components of different embodiments may be combined appropriately.

The apparatus of the present invention is applied to an image compression process in a communication, a storage and a broadcast.

A part or all of the encoding apparatus and decoding apparatus relating to the above embodiments may be implemented as a integrated circuit such as LSI (Large Scale Integration) or as a set of Integrated Circuit chips. An integrated-circuit technology is not limited to LSI and may be realized by a dedicated circuit or a general-purpose processor.

Each of function blocks as shown in FIGS. **2**, **3**, **6** and **12** may be implemented by a respective processor or a part or all of each function block are integrated into a processor.

Additional advantages and modifications will readily occur to those skilled in the art. Therefore, the invention in its broader aspects is not limited to the specific details and representative embodiments shown and described herein. Accordingly, various modifications may be made without departing from the spirit or scope of the general inventive concept as defined by the appended claims and their equivalents.

What is claimed is:

1. A video decoding apparatus comprising:

processing circuitry configured to:

acquire an available block having a motion vector from decoded blocks adjacent to a to-be-decoded block and a number of the available block;

select a selected block from the available block;

select a selected code table from a plurality of code tables depending on the number of the available block; and

decode selection information specifying the selected block using the selected code table, the selected code table including index and code words corresponding to the index, and the to-be-decoded block by using a motion vector of the selected block, wherein a number of the index is determined depending on the number of the available block.

2. A video decoding method comprising:

acquiring an available block having motion vectors from decoded blocks adjacent to a to-be-decoded block and a number of the available block from decoded blocks adjacent to a to-be-decoded block;

selecting a selected block from the available block;

selecting a selected code table from a plurality of code tables depending on the number of the available block; and

decoding selection information specifying the selected block using the selected code table, the selected code table including index and code words corresponding to the index, and the to-be-decoded block by using a motion vector of the selected block, wherein a number of the index is determined depending on the number of the available block.

3. A video decoding apparatus comprising a computer constructed and arranged to:

acquire an available block having motion vectors from decoded blocks adjacent to a to-be-decoded block and a number of the available block;

select a selected block from the available block;

select a selected code table from a plurality of code tables depending on the number of the available block; and

decode selection information specifying the selected block using the selected code table, the selected code table including index and code words corresponding to the index, and the to-be-decoded block by using a motion vector of the selected block, wherein a number of the index is determined depending on the number of the available block.

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